United States Patent [19]

Cox

[11] **4,347,197**

[45] **Aug. 31, 1982**

[54] **WATER DISTRIBUTOR**

[75] Inventor: **Randolph B. Cox,** Madison, Wis.

[73] Assignee: **Research Products Corporation,** Madison, Wis.

[21] Appl. No.: **148,775**

[22] Filed: **May 12, 1980**

[51] **Int. Cl.**[3] **B01F 3/04**

[52] **U.S. Cl.** **261/106;** 239/43; 239/49

[58] **Field of Search** 261/106, 103; 239/37, 239/43, 44, 49

[56] **References Cited**

U.S. PATENT DOCUMENTS

1,023,063	4/1912	Bassford	261/106
1,107,455	8/1914	Sintz	261/103
1,576,745	3/1926	Hanford	239/49
1,815,864	7/1931	Patrick	261/106
2,356,757	8/1944	Fleisher	261/106
2,529,839	11/1950	Garvey et al.	261/106
2,670,941	3/1954	Feinberg	62/177
2,773,555	12/1956	Pape	55/193
2,911,056	11/1959	Edel	261/103
2,947,452	8/1960	Frohmader et al.	62/314
3,254,841	6/1966	Loncker, Sr.	239/43
3,284,068	11/1966	Goettl	261/97
3,612,033	10/1971	Chilcoat	261/106
3,625,491	2/1969	Yokoi et al.	261/106

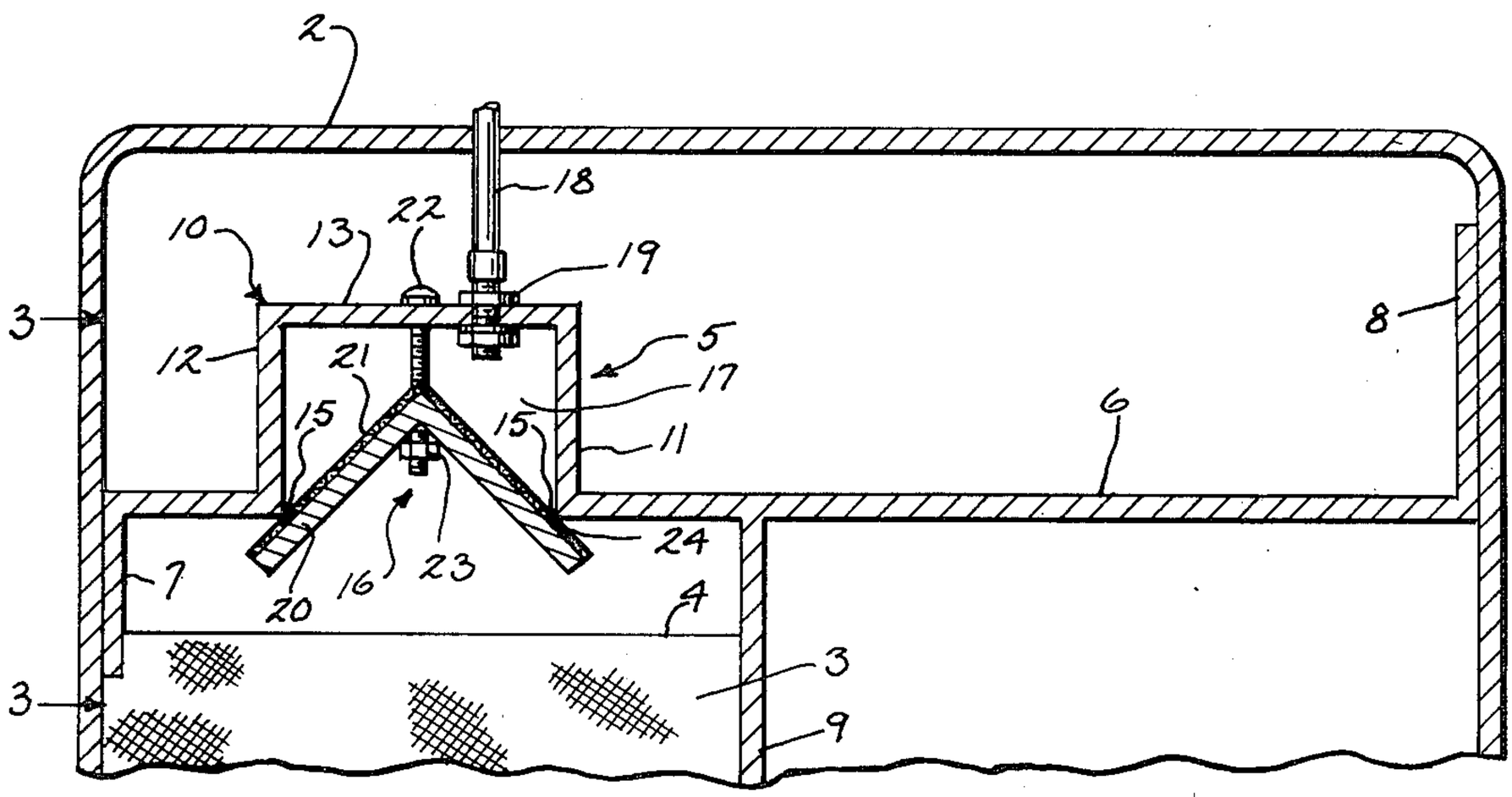
Primary Examiner—Tim R. Miles

Attorney, Agent, or Firm—Andrus, Sceales, Starke & Sawall

[57] **ABSTRACT**

A water distributor is disposed above an air-liquid contact pad, and is supplied with water from a supply line. The water is received within an elongated enclosed chamber having at least one elongated corner in its lower portion. A floor portion of the chamber is formed of an imperferate slightly flexible wall disposed generally tangential to the corner. A screen is disposed on the inner surface of the floor portion and is manually adjusted to engage with the said corner in a line contact relationship to form a water flow restriction or gap. The chamber above the restriction is sealed. During each cycle of operation, as water initially flows into the chamber, a miniscus forms at the gap which prevents water discharge. As the chamber fills with water, the air thereabove is trapped and pressurized and, together with the pressure of the accumulating head of water, gradually increases the pressure on the miniscus. Eventually, the surface tension at the miniscus breaks, allowing the water to flow downwardly through the gap.

9 Claims, 9 Drawing Figures



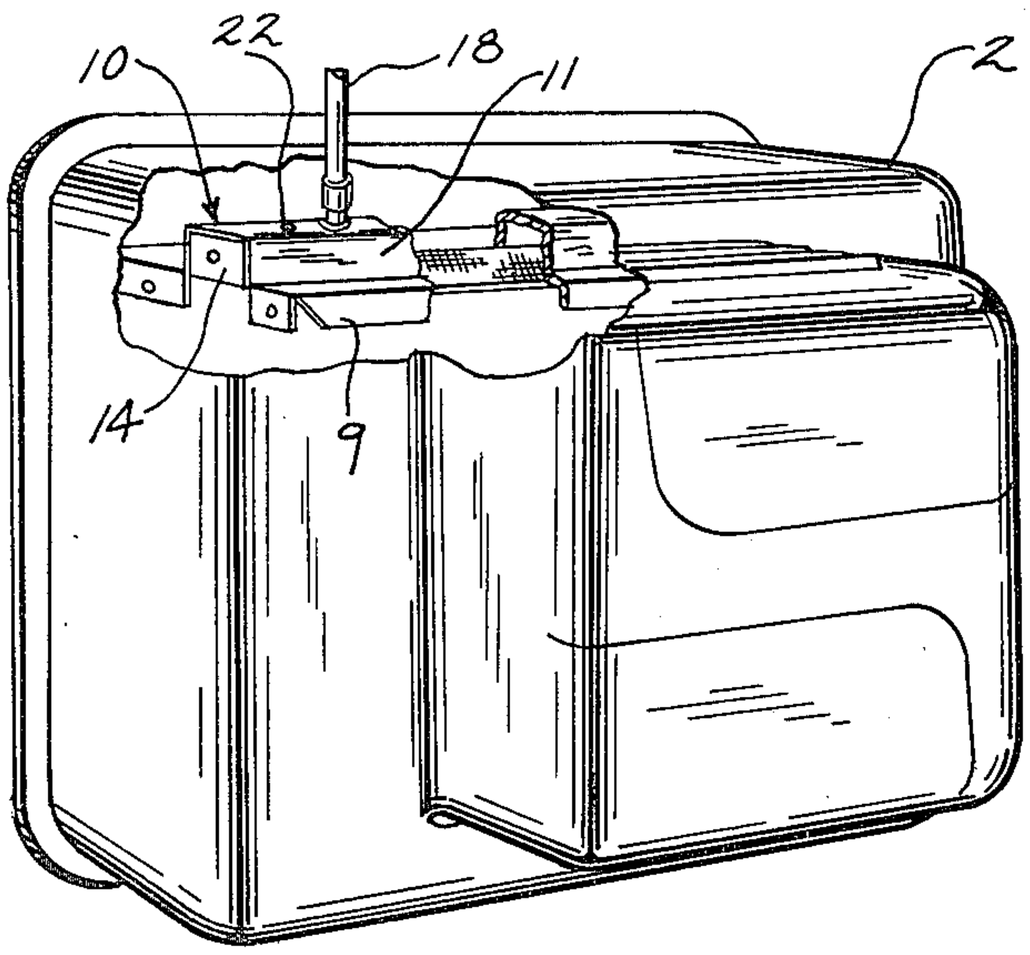


Fig. 1

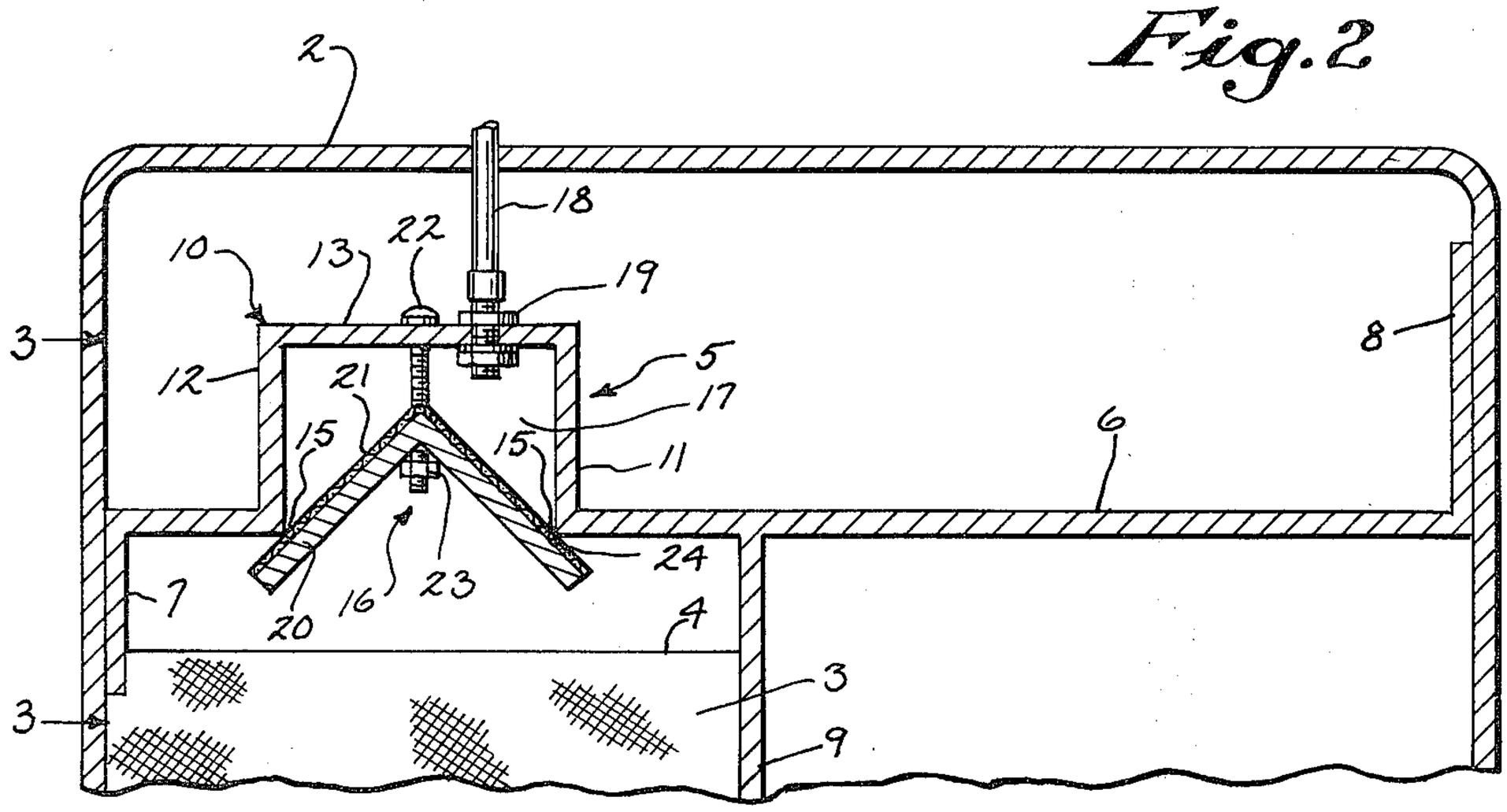


Fig. 2

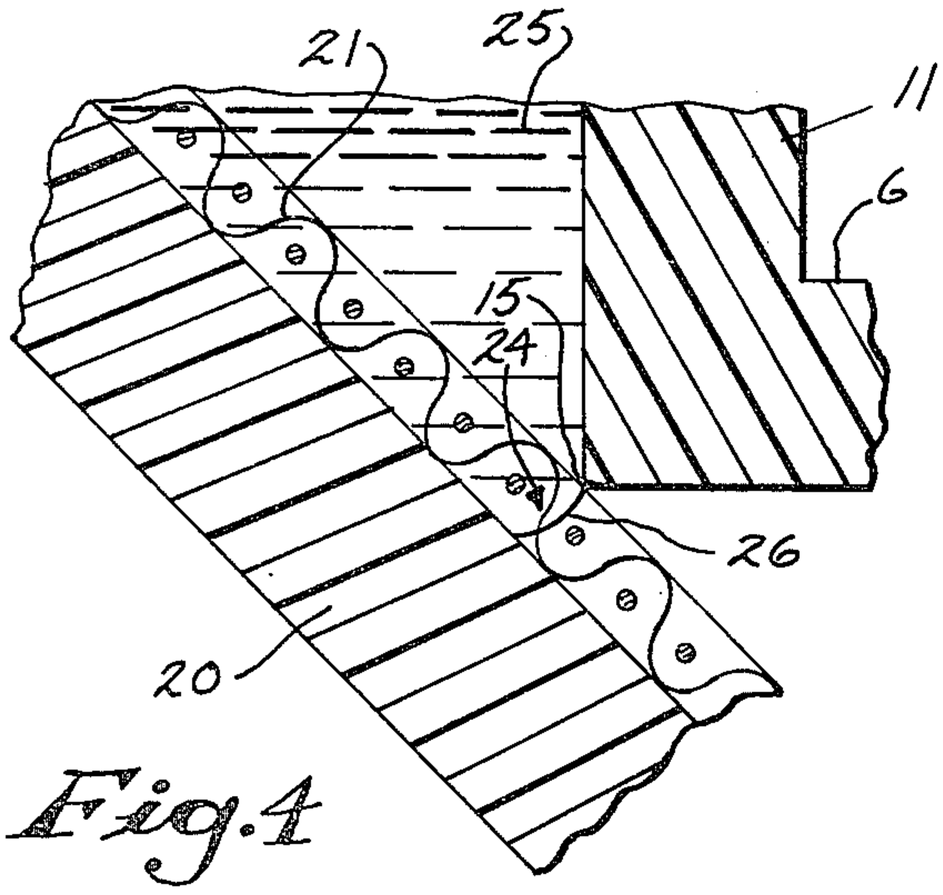


Fig. 4

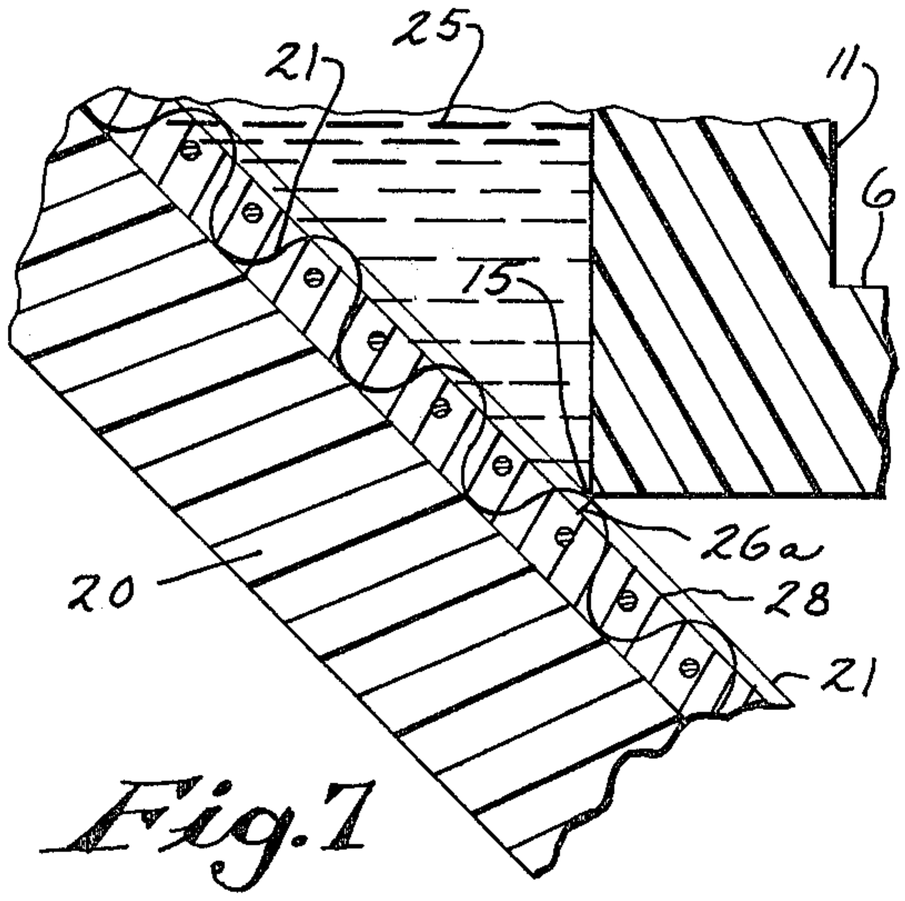


Fig. 7

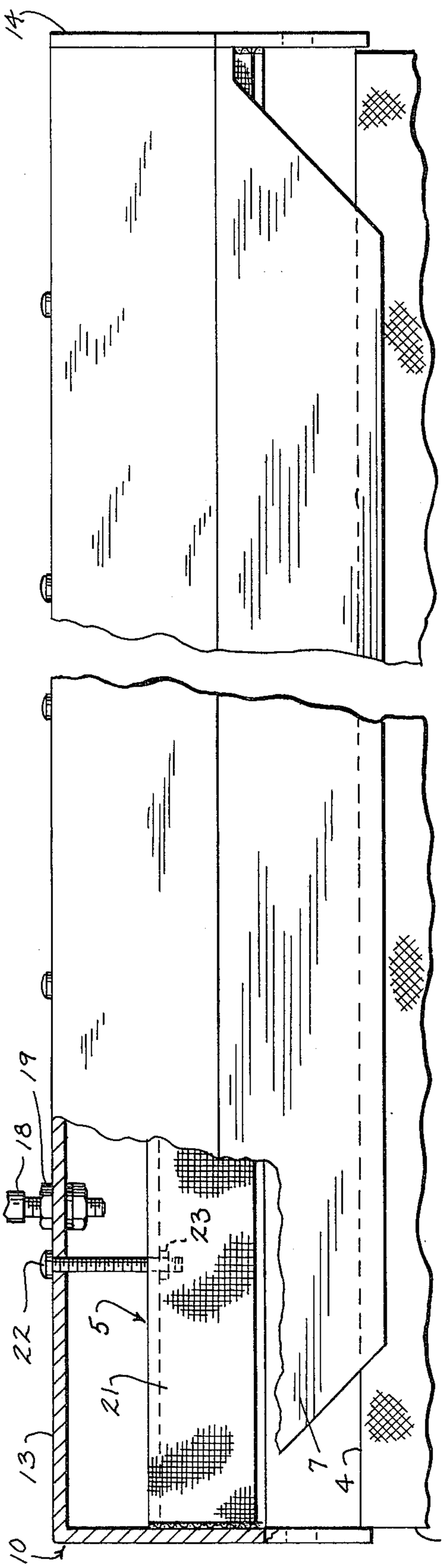


Fig. 3

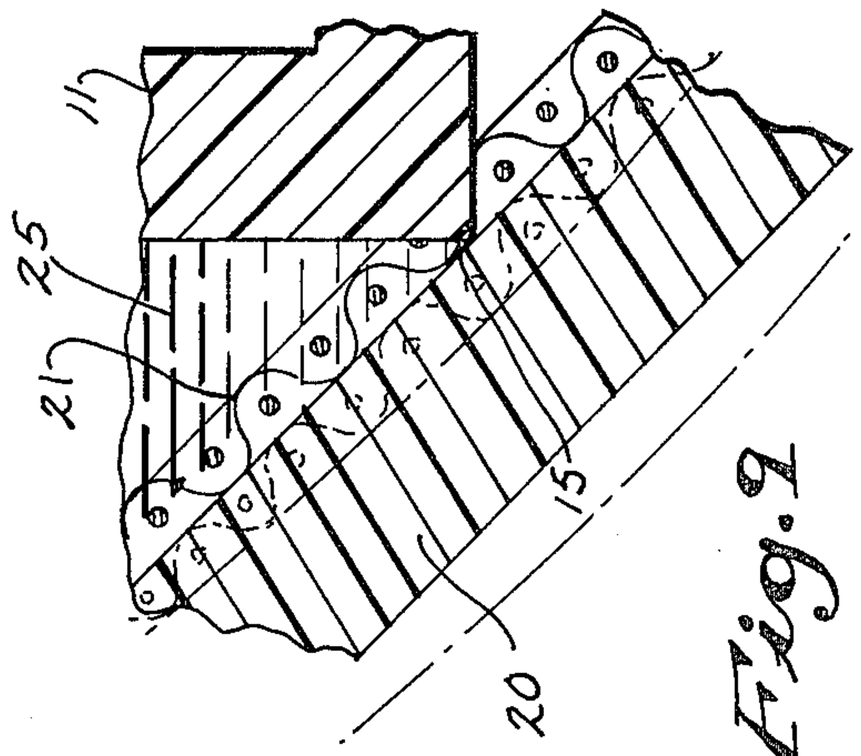


Fig. 4

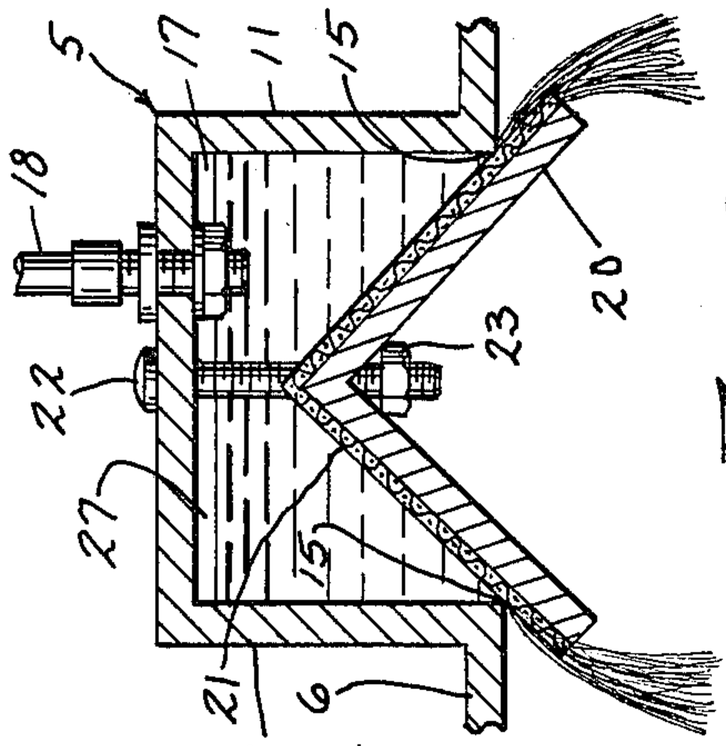


Fig. 8

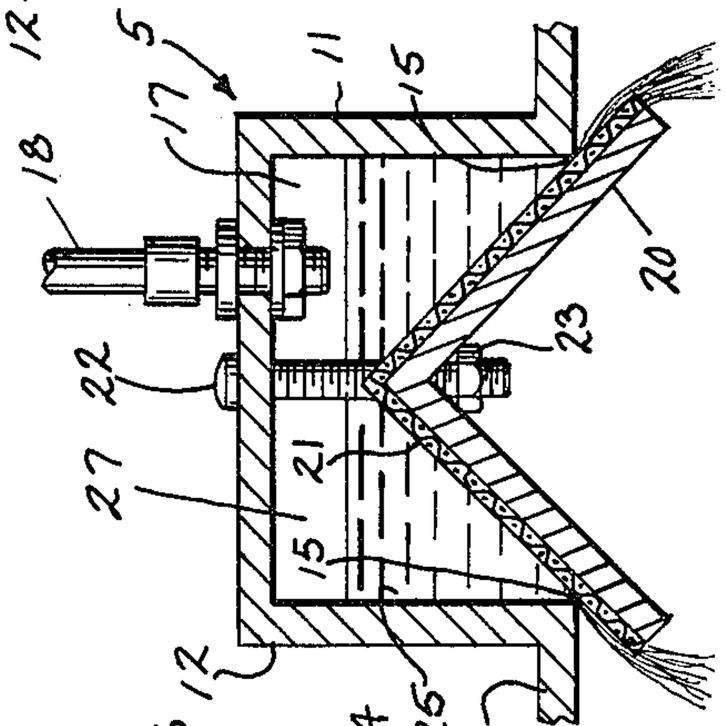


Fig. 6

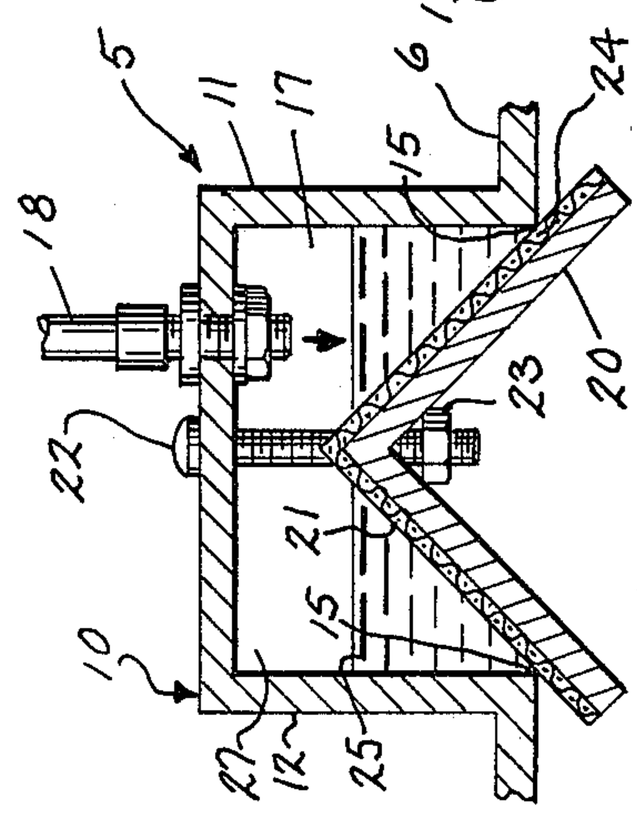


Fig. 7

WATER DISTRIBUTOR

U.S. PRIOR ART OF INTEREST

U.S. Pat. No. 1,107,455—Sintz—Aug. 18, 1914
U.S. Pat. No. 2,670,941—Feinberg—Mar. 2, 1954
U.S. Pat. No. 2,773,555—Pape—Dec. 11, 1956
U.S. Pat. No. 2,947,452—Frohmader et al—Aug. 2, 1960
U.S. Pat. No. 3,284,068—Goettl—Nov. 8, 1966.

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a water distributor and more particularly to a distributor for supplying a uniform flow of water to the top of an air-liquid contact pad used in air treatment devices, such as humidifiers and evaporative colors.

The invention is an improvement over the devices disclosed in the above-identified U.S. Pat. Nos. 2,947,452 and 3,284,068.

In U.S. Pat. No. 2,947,452, an open-topped distributor tray is disposed over the edge of a gas-liquid contact pad and is supplied with water from above through a suitable supply line. A plurality of openings in the bottom of the tray permit gravity flow of water therethrough and downwardly onto the pad. While this device has been commercially successful, it is subject to certain disadvantages. The area surrounding the openings will, in time, lime up, thus adversely affecting the desired water flow rate. Furthermore, the device may not provide an even distribution of water to the pad, especially if the tray is tilted from the horizontal. In addition, and with a given fixed water flow rate from the supply line, there is no means for adjusting the flow rate downwardly from the tray.

The U.S. Pat. No. 3,284,068 solves some of the aforementioned problems and utilizes a sponge disposed between two vertical plates having spaced horizontal ribs which are adjustable to compress the sponge therebetween in a flow restrictive manner. This device is subject to a number of disadvantages. The sponge is likely to disintegrate in time, requiring regular replacement. Furthermore, the sponge will also lime up, causing the restriction between the compressive ribs to be reduced. The only solution for this is to adjustably enlarge the space between the ribs.

The present invention solves all of the aforementioned problems and is based on a unique concept of water distribution which is self compensating for buildup of deposits.

In accordance with one aspect of the invention, the water from the supply line is received within an elongated enclosed chamber having at least one elongated corner in its lower portion. A floor portion of the chamber is formed of an imperferate slightly flexible wall disposed generally tangential to the corner. A screen is disposed on the inner surface of the floor portion and is manually adjustable to engage with the said corner in a line contact relationship to form a water flow restriction or gap.

In accordance with another aspect of the invention, the chamber above the restriction is essentially sealed. During each cycle of operation, as water initially flows into the chamber, a miniscus forms at the gap which prevents water discharge. As the chamber fills with water, the air thereabove is trapped and pressurized and, together with the pressure of the accumated head

of water, gradually increases the pressure on the miniscus. Eventually, the surface tension at the miniscus breaks, allowing the water to flow downwardly through the gap.

In accordance with yet another asepct of the invention, the device is self-adjusting or self-compensating for buildup of deposits of lime or other minerals. As the deposits accumulate at the gap, the miniscus diminishes, requiring a greater head of water and a smaller but more highly pressurized volume of trapped air, before the surface tension is broken. Once broken, however, the water will again flow through the gap.

In accordance with a further aspect of the invention, water will be discharged from the distributor even if deposit buildup has completely closed the gap or if, by adjustment, the screen has been compressed to the point that the chamber floor portion engages the said chamber corner. Under such circumstances, line pressure will build up along the gap, causing the flexible chamber floor portion to flex outwardly away from the corner to reopen the channel for water flow.

In accordance with yet another aspect of the invention, when a pair of parallel spaced corners are disposed in the bottom of the chamber, the chamber floor portion may comprise an elongated inverted V-shaped member with the screen covering its upper surface. The member is adjustable relative to the corners by means of a plurality of bolts.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the best mode presently contemplated by the inventor for carrying out the invention.

In the drawings:

FIG. **1** is a perspective view of a humidifier adapted to incorporate the concepts of the invention;

FIG. **2** is a transverse sectional view of a portion of the humidifier;

FIG. **3** is a sectional view taken on line **3—3** of FIG. **2**;

FIG. **4** is an enlarged fragmentary view showing a bottom corner of the chamber with the water held back by a miniscus;

FIG. **5** is a full view of the chamber under the conditions shown in FIG. **4**;

FIG. **6** is a view similar to FIG. **5** after the surface tension has been broken;

FIG. **7** is a view similar to FIG. **4** showing the buildup of minerals;

FIG. **8** is a full view of the chamber under the conditions shown in FIG. **7** and with the release of water; and

FIG. **9** is a view similar to FIG. **4** showing flexing of the chamber floor portion.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1–3** of the drawings, the concepts of the invention may be embodied in an air treatment apparatus, such as a humidifier **1** having a housing **2** and an air-liquid contact pad **3** of any suitable well-known type mounted therein. A fan, not shown, is adapted to blow air through pad **3** where it contacts water flowing down through the pad. The water is supplied to the top edge **4** of pad **3** by the distributor **5** which forms the subject of the present invention.

Distributor **5** may be mounted within housing **2** by any suitable means. As shown, a horizontal platform **6** is

disposed within housing **2** and is spaced from the top thereof. The rear of platform **6** is flanged downwardly as at **7** and the front of the platform is flanged upwardly as at **8**, with the flanges engaging housing **2** and secured thereto if desired by any suitable means, not shown. A longitudinal flap **9** extends downwardly between flanges **7** and **8** and may assist in holding pad **3** in place.

In the area directly over pad **3**, platform **6** is formed upwardly into an elongated distributor channel **10** having front and rear walls **11**, **12** a top wall **13** and end walls **14**. Distributor channel **10** is shown as integrally formed with platform **6**, although it may be of separate construction. The channel is preferably made of a suitable extruded plastic such as PVC, and forms with platform **6** a pair of elongated horizontally spaced facing corners **15**. Corners **15** are shown in the present embodiment as sharp edges, but they may be curved to at least some extent without departing from the spirit of the invention.

The walls of channel **10** cooperate with a flow control assembly **16** to form an enclosed elongated chamber **17** adapted to receive water through a supply line **18** which is sealingly connected into top wall **13** as by a fitting **19**.

In the present embodiment, the flow control assembly **16** comprises an imperforate member **20** forming a floor of chamber **17** and which is co-extensive with channel **10** and adjacent and generally tangential to corners **15**. Member **20** is shown in this embodiment as being of inverted V-shape with the walls thereof converging at about 90°. Member **20** is slightly flexible and is also preferably made of extruded plastic such as PVC. For purposes of precise flow control, a flexible screen **21** extends over and is backed by the upper surface of member **20** and is disposed between the latter and corners **15**. Member **20** and screen **21** extend upwardly within channel **10** and with their lower free edge portions extending downwardly and outwardly below corners **15** externally of chamber **17**.

Screen **21** is preferably of the so-called insect screening type with about an 18×16 mesh, and can be made of fiberglass.

Assembly **16** is held in position and is manually adjustable in a vertical direction by a plurality of bolts **22** which is spaced longitudinally along channel **10**. Each bolt **22** extends downwardly through top wall **13** and through the upper corner of assembly **16**, with a nut **23** disposed beneath the assembly so that the latter is suspended therefrom.

From desired operation of the distributor, and referring to FIGS. **2**, **3** and **5**, assembly **16** is confined between corners **15** and floor member **20** to form slit-like restrictions or gaps **24** wherein corners **15** and member **20** are spaced apart and in engagement with the screen. Screen **21** may be slightly compressed by these members.

The construction is such that water does not freely flow from chamber **17** through gaps **24**, but rather normally requires pressurization from within the chamber. As water **25** flows into chamber **17** a miniscus **26** forms across screen **21** between each corner **15** and floor member **20**. See FIG. **4**. It has been found that screen **21** assists in formation of the miniscus so that water **25** is held back against the force of gravity and does not flow through gaps **24**.

FIG. **5** shows the full view of the distributor under the conditions of FIG. **4**. As the water rises, and due to the construction wherein chamber **17** is sealed above gaps **24**, a compressed air pocket **27** forms above water **25** with the air pressure in the pocket continuously increasing.

Finally, the pressure created at gaps **24** by the combination of (a) the heat of water in chamber **17** and (b) the air pocket pressure, will cause the surface tension at each minscus **26** to be broken. As shown in FIG. **6**, water then discharges through gaps **24** and falls in a pair of curtain-like droplets or streams for engagement with pad **3**. The pocket air pressure then decreases.

As in example, it may be desired to provide a water distribution rate of 7 gallons per minute per lineal foot of pad **3**. The pressure and constant rate of water flow through line **18** is adjusted to provide that total amount of water. With gaps **24** set as in FIG. **4**, it may take an effective chamber pressure of $1\frac{1}{2}''$ to break miniscus **26**. When water **25** has risen 1", the air pocket pressure may be risen to an equivelant of an additional $\frac{1}{2}''$ of water pressure, at which point the miniscus breaks. The water will subsequently flow at the desired rate, not under line pressure, but under the chamber pressure. An equilibrium condition, such as that shown in FIG. **6**, will continue as long as the flow rate through line **18** is unchanged.

The device of the invention is automatically self-adjusting and self-compensating for any buildup of deposits, such as lime or other minerals, without the need for manual adjustment of bolts **22**. Referring to FIG. **7**, and with the same setting as in FIG. **4**, a buildup of deposits **28** has occured from floor wall **20** to near the upper portion of screen **21**. The deposits may or may not be as uniform as is shown. When water **25** flows into the distributor, only a very small miniscus **26***a* forms between corners **15** and deposits **28**. The diminished miniscus **26***a* will require substantially more chamber pressure from above before the surface tension breaks. Thus, and as shown in FIG. **8**, the head of water **25** will be greater and air pocket **27** will be substantially more compressed before water is discharged out of the distributor. Once this happens, however, the system will perform just as in FIGS. **4–6**.

The distributor of the invention incorporates a feature which permits continued discharge of water even if gaps **24** are completely clogged by deposits, or if bolts **22** are accidentally adjusted so that corners **15** and floor member **20** are in tight line engagement with screen **21** substantially completely crushed therebetween. FIG. **9** illustrates the latter condition. As water flows into chamber **17**, no miniscus forms. Water **25** will continue to rise until the chamber pressure at corners **15** has far exceeded the usual operative miniscus-breaking pressures. At this point, floor member **20**, being flexible and having free edges closely adjacent and just below corners **15**, is forced to flex away from the corners, as shown in phantom in FIG. **9**. Screen **21** is carried with member **20**. A gap is thus automatically provided through which the water will be discharged.

The concepts of the invention provide a unique and major improvement over previous water distributors. The device is relatively easy to manufacture, assemble, control and maintain.

While the present embodiment illustrates a pair of water flow restrictions or gaps **24** at the bottom of chamber **17**, any other number of restrictions may be utilized without departing from the spirit of the invention. Also, the shape of floor member **20** may be other than V-shaped.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A distributor for the uniform supply of water from a water input line operating at line pressure to an extended area disposed therebeneath, said distributor comprising:

(a) means forming an elongated chamber adapted for connection with said water line, said chamber having at least one elongated restrictive gap disposed in its lower portion,

(b) means disposed in said gap for causing the formation of a miniscus across said gap as water flows into said chamber from said water line, to thereby prevent water from flowing through said gap,

(c) said chamber being enclosed and being generally sealed above said gap so that said chamber becomes pressurized below the said line pressure as water rises therein whereby said miniscus is ultimately broken by the rising pressure within said chamber to permit water to be discharged downwardly through said gap,

(d) said gap being defined by:

(1) a corner disposed in a chamber wall,

(2) and a flow control assembly disposed adjacent said corner and generally tangential thereto.

2. The distributor of claim **1** wherein the construction is such that as said water rises in said chamber, to form a pressurized water head, an air pocket is formed above the water which adds to the pressure of said water head on said miniscus.

3. The distributor of claim **1** wherein said flow control assembly comprises:

(a) an imperforate backing member,

(b) and said miniscus forming means.

4. The distributor of claim **3** in which said miniscus forming means comprises a screen mounted on said backing member and facing said corner.

5. The distributor of claim **4** wherein buildup of deposits on said screen is automatically compensated for by a resultant diminishing of said miniscus and increased chamber pressure required to break said miniscus.

6. The distributor of claim **5** which includes means for manually adjusting said flow control assembly relative to said corner to thereby adjust the width of said gap.

7. The distributor of claim **6** wherein said flow control assembly is flexible and has a free edge portion disposed adjacent said corner so that in the event said gap is closed by said deposits or by said manual adjusting means, pressure within said chamber will cause said assembly to flex away from said corner to thereby open said gap.

8. The distributor of claim **3**, **4**, **5**, **6** or **7** wherein:

(a) said chamber includes a pair of said corners with the corners being spaced horizontally and in facing relationship,

(b) said flow control assembly is of inverted V-shape and extends upwardly into said chamber forming means to adjacent said corners,

(c) and said assembly adjusting means comprises a plurality of bolts spaced along said chamber forming means and extending through the latter and said flow control assembly.

9. A distributor for the uniform supply of water from a water input line operating at line pressure to an extended area disposed therebeneath, said distributor comprising:

(a) means forming an elongated chamber adapted for connection with said water line, said chamber having at least one elongated restrictive gap disposed in its lower portion,

(b) meand disposed in said gap for causing the formation of a miniscus across said gap as water flows into said chamber from said water line, to thereby prevent water from flowing through said gap,

(c) said chamber being enclosed and being generally sealed above said gap,

(d) said gap being defined by:

(1) a corner formed in a chamber wall,

(2) and a flow control assembly disposed closely adjacent said corner,

(e) said flow control assembly extending from within said chamber and past said corner to terminate outwardly beyond said corner in a free edge portion externally of the said chamber, said flow control assembly comprising:

(1) an imperforate backing member forming part of the means forming said chamber,

(2) and said miniscus forming means, and with the latter being disposed between said corner and said backing member.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,347,197

DATED : August 31, 1982

INVENTOR(S) : Randolph B. Cox

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 1, Line 18, Delete "colors" and substitute therefor
----coolers----;

Column 3, Line 50, Delete "From" and substitute therefor
----For----;

Column 4, Line 11, Delete "in" and substitute therefor
----an----;

Column 4, Line 18, Delete "be" and substitute therefor
----have----;

Column 6, Line 27, Delete "meand" and substitute therefor
----means----.

Signed and Sealed this

Seventh Day of *December 1982*

[SEAL]

Attest:

GERALD J. MOSSINGHOFF

Attesting Officer

Commissioner of Patents and Trademarks